

ERETMOCERUS HALDEMAN (HYMENOPTERA: APHELINIDAE) IN THE UNITED STATES, WITH DESCRIPTIONS OF NEW SPECIES ATTACKING *BEMISIA* (*TABACI* COMPLEX) (HOMOPTERA: ALEYRODIDAE)

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Abstract.—A key to species of *Eretmocerus* that occur in the continental United States is provided. *Eretmocerus eremicus*, n. sp., *E. joeballi*, n. sp., *E. staufferi*, n. sp., and *E. tejanus*, n. sp., all reared from *Bemisia* (*tabaci* complex) collected in the United States, are described. Redescriptions of *Eretmocerus californicus* Howard, *E. corni* Haldeman, *E. haldemani* Howard, and *E. portoricensis* Dozier are provided. *Eretmocerus debachii* Rose and Rosen, *E. furuhashii* Rose and Zolnerowich, and *E. illinoisensis* Dozier are discussed. Lectotypes are designated for *Eretmocerus californicus* Howard, *E. haldemani* Howard, and *E. portoricensis* Dozier.

Key Words: *Eretmocerus*, Aphelinidae, *Bemisia*, Aleyrodidae, biological control

Species of *Eretmocerus* Haldeman, 1850 (Hymenoptera: Chalcidoidea: Aphelinidae) are attracting widespread interest because of population explosions of *Bemisia* (*tabaci* complex) (Homoptera: Aleyrodidae) around the world (Rose et al. 1996). All known species of *Eretmocerus* are primary parasites of whitefly, and species of *Eretmocerus* have been purposefully utilized in effective biological control programs (Rose and DeBach 1991–1992; Rose and Rosen 1991–92; Rose 1988). This paper, which is part of a larger study of *Eretmocerus* species of the world, is designed to clarify characterizations of named species in the U.S., and to describe new species that attack *Bemisia* (*tabaci* complex) in the U.S.

Because of confusion regarding the use of the names *Bemisia tabaci* (Gennadius) A-strain, *B. tabaci* B-strain, and *B. argentifolii* Bellows and Perring on specimen labels and in the literature (Brown et al. 1995), we refer to hosts from this group as *Bemisia* (*tabaci* complex). Species of *Bemisia* (*tabaci* complex) have emerged as a

major agricultural pest attacking a variety of food, cash, and ornamental crops in the United States and abroad. *Bemisia* (*tabaci* complex) attacks over 500 plant species in 74 families (Mound and Halsey 1978; Brown and Bird 1992) and new host plants are continually being added (Gill 1992; Costa et al. 1993). Crop damage occurs due to feeding, honeydew production and resultant sooty mold, and disease transmission. Species in the *Bemisia* (*tabaci* complex) transmit more than 15 viruses (Byrne et al. 1990) that cause more than 40 plant diseases (Brown and Bird 1992). Reflecting the current U.S. situation, *Bemisia* (*tabaci* complex) is a major pest of crops in Mexico, the Caribbean, Central and South America, the Middle East, India, and parts of Africa.

Biological control research to attain population regulation of *Bemisia* (*tabaci* complex) in the U.S. is emphasizing evaluation of naturally occurring species of parasitic Hymenoptera and importation of exotic populations and species of parasites. The

majority of native and imported species are found in *Eretmocerus* and *Encarsia* Foerster (Hymenoptera: Chalcidoidea: Aphelinidae). Polaszek et al. (1992) provided a key and discussion of *Encarsia* species that attack *Bemisia (tabaci)* complex). Schauff et al. (1996) furnished a pictorial key and discussion of species of *Encarsia* that attack whitefly in North America. Species of *Amitus* Haldeman (Hymenoptera: Platygastriidae) also have been reared from *Bemisia (tabaci)* complex) (Viggiani and Evans 1992).

Surveys to obtain samples of *Bemisia (tabaci)* complex) and its parasites from various host plants in the U.S. have been undertaken primarily in Arizona, California, Florida, and Texas. These states have suffered the greatest damage to field crops and subsequent losses to *Bemisia (tabaci)* complex), so biological control research efforts have been emphasized in these areas. It is vitally important that researchers in these and other areas are able to identify the biological entities they are discovering, importing, colonizing and evaluating.

There are currently 8 described species of *Eretmocerus* from the New World, and 30 species are known from the Old World. Given that there are nearly 1200 described species of whitefly, and that species of *Eretmocerus* are known from all continents where whitefly occur, there are undoubtedly many more undescribed species of *Eretmocerus*. Because most species of *Eretmocerus* have been reared from agricultural pests, little is known of the actual range of these species. Likewise, little is known about species found outside of agricultural settings.

The literature encompassing the taxonomy of *Eretmocerus* is disparate in its comprehensiveness, and researchers have relied on historical taxonomy to provide names for numerous species of *Eretmocerus* that are currently being studied and transferred nationally and internationally. These historical names often find their way into new literature and are then generally adopted,

which may obscure the actual species being studied. For example, two of the species described in this paper were called *E. californicus* or *E. sp. nr. californicus* for many years.

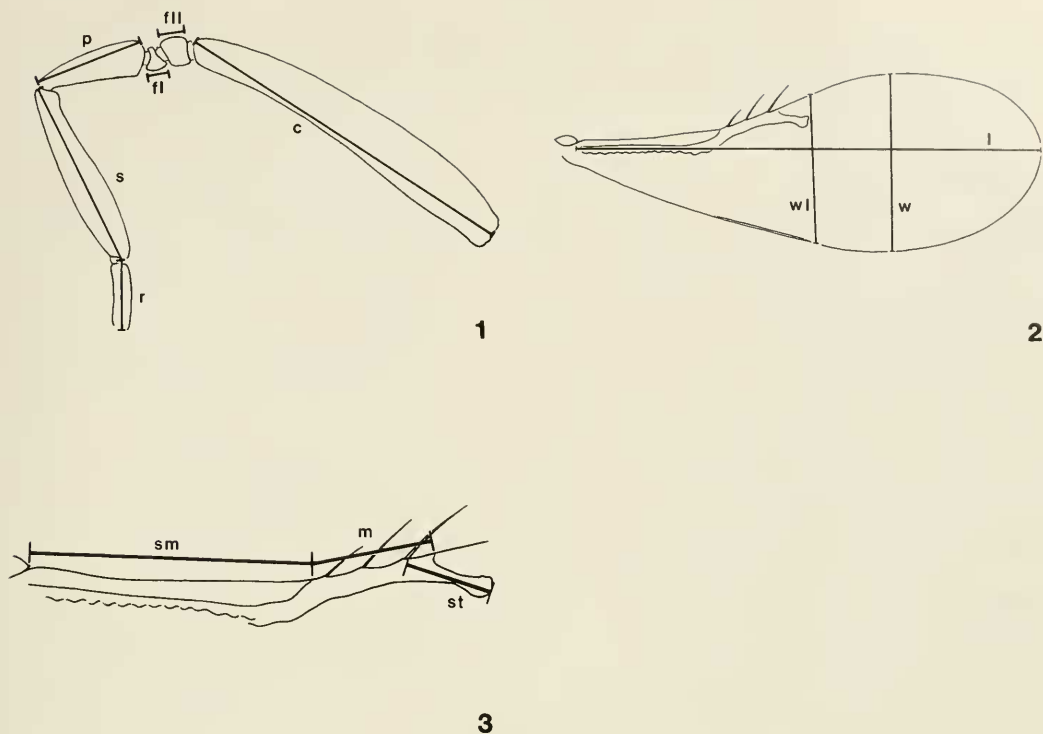
Previous studies (Rose and Rosen 1991–1992, Rose and Zolnerowich 1994, Rose et al. 1996, Hunter et al. 1996) have emphasized developing criteria for the characterization of species based on morphology, pigment patterns of males, reciprocal mating trials, and electrophoretic analysis. These studies all indicate that minor morphological differences in the size, shape, or chaetotaxy of the habitus, antennae, and forewings, and pigment patterns of males, are significant species characters.

Males of different species of *Eretmocerus* are very similar unless they have features such as distinct pigment patterns. The poor condition of male specimens available for *Eretmocerus haldemani* and *E. illinoisensis* preclude their separation in the key to species. Males are unknown for *Eretmocerus joeballi* and *E. portoricensis*.

METHODS

High quality microslide mounts are necessary to correctly examine and identify species of *Eretmocerus*. Because clearing and mounting specimens in balsam removes all or most of their color, most specimens used in this study were mounted in Hoyer's medium as described by Rosen and DeBach (1979), and the cover slips were sealed with two coats of red GLPT, a nonconducting insulating varnish used in electronics (GC Electronics, Rockford, Illinois). Other specimens were critical point-dried and mounted on cards prior to mounting in balsam. Most primary type material was mounted in balsam.

Position of the body and antenna on microslides is critical for proper identification. The antenna should be examined from the lateral aspect. Viewing the antenna from any other angle obscures the true length and shape of the segments. In many instances, the antennae were removed from the head



Figs. 1-3. 1, ♀ antenna. 2, Forewing. 3, Venation of forewing. c = length of club, fl = length of first funicular segment, flI = length of second funicular segment, l = length of forewing, m = length of marginal vein, p = length of pedicel, r = length of radicle, s = length of scape, sm = length of submarginal vein, st = length of length of stigmal vein, w = greatest width of disc, wI = width I.

and mounted separately on the same slide. Wings should be positioned away from the body to reveal their shape and allow accurate measurements to be made.

Length of the body was measured from critical point-dried specimens using an eye-piece micrometer when possible. Other measurements of specimens mounted in balsam or Hoyer's were taken using an eye-piece micrometer or a digitizing tablet. The maximum length of each antennal article in lateral view was measured (Fig. 1). The antennal ratios given in descriptions are the ratios of the lengths of the radicle : scape : pedicel : club. Unless expressed as a range, the length : width ratios represent average values.

Length and width of the forewing were measured as shown in Fig. 2. The maximum length (l) and width of the wing across the disc (w) were measured. Width I

(wI) is the distance between the distal end of the frenal fold and the anterior margin of the forewing above the distal end of the stigmal vein. Points of measurement for the lengths of the submarginal, marginal, and stigmal veins are shown in Fig. 3. The ratios of the lengths of the longest anterior and posterior alary fringes (Fig. 5) to the width of the wing are given, as is the number of tubercles (Fig. 11), which are present on the ventral side of the wing.

In many instances, the distal boundary of the marginal vein and the advent of the stigmal vein were not clearly delimited. In those cases, the end of the marginal vein and the beginning of the stigmal vein were taken at the base of the distal large seta on the marginal vein (Fig. 3, st).

Descriptions of color for critical point-dried and specimens mounted in Hoyer's may differ because of differences in speci-

Table 1. Species of *Eretmocerus* in the U.S. and original collection data.

Species	Author	Year	Original Host Insect
<i>corni</i> types lost	Haldeman	1850	<i>Tetraleurodes corni</i> (Haldeman) [= <i>Aleurodes corni</i> Haldeman]
<i>corni</i> neotype	Dozier	1932	<i>Trialeurodes packardi</i> (Morrill) [= <i>Trialeurodes morrilli</i> (Britton)]
<i>californicus</i>	Howard	1895	unknown "Aleyrodes"
<i>haldemani</i>	Howard	1908	<i>Aleuroplatus coronata</i> (Quaintance) [= <i>Aleyrodes coronata</i> Quaintance]
<i>illinoisensis</i>	Dozier	1932	unknown
<i>portoricensis</i>	Dozier	1932	<i>Aleurothrix floccosus</i> (Maskell)
<i>debachi</i>	Rose & Rosen	1991–92	<i>Parabemisia myricae</i> (Kuwana)
<i>furuhashii</i>	Rose & Zolnerowich	1994	<i>Parabemisia myricae</i> (Kuwana)
<i>eremicus</i>	Rose & Zolnerowich	1997	<i>Bemisia</i> (<i>tabaci</i> complex), possibly <i>Trialeurodes</i>
<i>joeballi</i>	Rose & Zolnerowich	1997	<i>Bemisia</i> (<i>tabaci</i> complex)
<i>staufferi</i>	Rose & Zolnerowich	1997	<i>Bemisia</i> (<i>tabaci</i> complex), <i>Trialeurodes abutiloneus</i> (Haldeman)
<i>tejanus</i>	Rose & Zolnerowich	1997	<i>Bemisia</i> (<i>tabaci</i> complex)

¹ Host plant probably *Quercus* (R. Gill, personal communication).

men preparation. Specimens mounted in Hoyer's do not show colors as well as critical point-dried material, but do show fuscous pigment patterns well. Descriptions of color or pigment are given for both critical point-dried and Hoyer's-mounted specimens where appropriate.

For new and described species, label data for primary types is presented exactly as recorded on the specimen labels, with the data for each individual label enclosed by quotation marks and each line of the label separated by a slash. Label data for material other than primary types are standardized and multiple records from the same locality may be combined. Table 1 provides summary information such as original locality, host, and host plant for the species of *Eretmocerus* discussed here.

The following acronyms represent institutions or individuals who loaned material for study, are repositories for type material, or are otherwise mentioned in the text: BMNH, The Natural History Museum,

London, United Kingdom; CDFR, California Department of Food and Agriculture, Sacramento; HU, The Hebrew University, Rehovot, Israel; INHS, Illinois Natural History Survey, Champaign; MJR, personal collection of M. J. Rose; NSM, National Science Museum, Tokyo, Japan; TAMU, Texas A&M University, College Station; UCR, University of California, Riverside; USNM, National Museum of Natural History, Smithsonian Institution, Washington, D.C.

KEY TO SPECIES OF *ERETMOCERUS* IN THE UNITED STATES

- 1 Female, antenna with 2 funicular segments (e.g., Figs. 1, 8) 2
- Male, antenna without funicular segments 11
- 2(1) Mesosoma brown to brown orange, contrasting strongly with head and metasoma (Fig. 25) *E. staufferi*, n. sp.
- Body yellow, mesosoma not contrasting with head and metasoma 3
- 3(2) Mesoscutum with 4 setae (Fig. 15) 4

Table 1. Continued.

Original Host Plant	Original Locality, Date
Cornaceae: <i>Cornus sericea</i> , dogwood	Pennsylvania, 1847
Balsaminaceae: <i>Impatiens biflora</i> , jewel weed	Pennsylvania, White Clay Creek, 1929
Fagaceae: <i>Quercus agrifolia</i> , California live oak unknown ¹	California, Los Angeles, 1887 California, Berkeley, 1908
unknown	Illinois, Elizabethtown, 1932
Burseraceae: <i>Bursera simaruba</i>	Puerto Rico; Bayamon & Central Aguirre, 1925
Zygophyllaceae: <i>Guaiacum officinale</i>	California, Orange County, 1982
Rutaceae: <i>Citrus</i> spp.	Japan: Honshu, 1979
Moraceae: <i>Morus</i> sp., mulberry	Arizona, Phoenix, 1991
Malvaceae: <i>Gossypium hirsutum</i> , cotton	California, Bakersfield, 1993
Moraceae: <i>Morus</i> sp.	Texas, College Station, 1993
Solanaceae: <i>Solanum</i>	Texas, Mission, 1994
Solanaceae: <i>Lycopersicon</i> , tomato	
Cruciferae: <i>Brassica oleracea</i> , cabbage	

<p>– Mesoscutum with 6 setae 5</p> <p>4(3) Parapsis with 2 setae; club 4.1–4.5 times as long as its greatest width (Fig. 8) <i>E. debachi</i></p> <p>– Parapsis with 3 setae (Fig. 15); club 4.3–5.6 times as long as its greatest width (Fig. 13) <i>E. furuhashii</i></p> <p>5(3) Club 3.2–3.8 times as long as wide, with dorsal surface convex and contrasting with straight ventral surface (Fig. 20) <i>E. portoricensis</i></p> <p>– Club 4.5–8.3 times as long as wide, and with dorsal and ventral surfaces more or less parallel (e.g., Figs. 4, 26) 6</p> <p>6(5) Dorsal surface of club apically tapered so that apex forms a broad point (Fig. 4); radicle 0.6 times or more as long as scape <i>E. californicus</i></p> <p>– Apex of club truncate; radicle 0.35–0.50 times as long as scape (e.g., Figs. 16, 26) 7</p> <p>7(6) Pedicel short, 2–2.3 times as long as wide; club 4.5–5.1 times as long as wide (Fig. 18); ovipositor 1.5 times as long as club and 1.3 times as long as midtibia <i>E. joeballi</i>, n. sp.</p> <p>– Pedicel longer, 2.5–4 times as long as wide; club 5.9–8.3 times as long as wide (e.g., Figs. 6, 16); ovipositor shorter than or equal to length of club or midtibia 8</p>	<p>8(7) Scape at least 6.5 times as long as wide (Fig. 16); midbasitarsus 8.5 times as long as wide <i>E. haldemani</i></p> <p>– Scape 3.5–5.5 times as long as wide (e.g., Fig. 10); midbasitarsus 5.5–8.3 times as long as wide 9</p> <p>9(8) Pedicel 2.4–3.1 times as long as wide, and 0.25–0.3 times as long as club (Fig. 6); reared from <i>Trialeurodes</i> <i>E. corni</i></p> <p>– Pedicel 3–4 times as long as wide, and 0.29–0.39 times as long as club (Fig. 10); reared from <i>Bemisia (tabaci)</i> complex and possibly <i>Trialeurodes</i> 10</p> <p>10(9) Gastral tergite II usually with 1 pair, but occasionally 2 pairs, of lateral setae (Fig. 12); gastral sternites anterior to base of ovipositor usually with a group of 4–5 setae, occasionally with 3–6 setae <i>E. eremicus</i>, n. sp.</p> <p>– Gastral tergite II usually with 2 pairs, but occasionally 1 pair, of lateral setae (Fig. 28); gastral sternites anterior to base of ovipositor usually with a group of 7–8 setae, occasionally with 5–6 setae <i>E. tejanus</i>, n. sp.</p> <p>11(1) Mesoscutum with 4 setae (Fig. 15) 12</p> <p>– Mesoscutum with 6 setae 13</p> <p>12(11) Parapsis with 2 setae; mesoscutum with dark fuscous “T” shape; scutellum completely fuscous (Fig. 29) <i>E. debachi</i></p>
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- Parapsis with 3 setae (Fig. 15); mesoscutum with light fuscous "T" shape; scutellum medially fuscous, lateral areas unpigmented (Fig. 31) *E. furuhashii*
- 13(11) Entire mesosoma brown to brown orange, contrasting strongly with head and metasoma (Fig. 32) *E. staufferi*, n. sp.
- Mesosoma not brown to brown orange, although fuscous pigment patterns on pronotum, mesoscutum, or scutellum may be present or absent (e.g., Figs. 30, 33) 14
- 14(13) Mesoscutum with longitudinal fuscous bands (Fig. 33) *E. tejanus*, n. sp.
- Mesoscutum without longitudinal fuscous bands 15
- 15(14) Mesoscutum fuscous along anterior margin (Fig. 30), or with a light fuscous "T" shape (as in Fig. 31), or evenly fuscous 16
- Mesoscutum not fuscous 17
- 16(15) Hind tibia fuscous *E. eremicus*, n. sp.
- Hind tibia not fuscous *E. corni*
- 17(15) Scape 2.5–2.8 times as long as pedicel *E. californicus*
- Scape 3.2–4 times as long as pedicel *E. haldemani*, *E. illinoisensis*

Eretmocerus californicus Howard
(Figs. 4–5)

Eretmocerus californicus Howard, 1895: 16
[USNM, examined].

Type material. Lectotype here designated, ♀ mounted in balsam on a slide labelled, "Name *Eretmocerus/californicus*/Howard/REMOUNT/Det HOWARD 19 1895/Coll D. W. Coquillett/No. USNM 2699/Corr. LECTOTYPE" "♀/1" "Loc Los Angeles/California/Date VI-9 19 1887/Host *Aleyrodes*/Det 19/On *Quercus/agrifolia*".

There are an additional five ♀ and 16 ♂ paralectotypes mounted on 15 slides [USNM].

Diagnosis. Females of *E. californicus* can be distinguished by the length of the radicle, which is 0.6× or more than the length of the scape, the extremely reduced first funicular segment, and the tapered shape of the club (Fig. 4). *Eretmocerus californicus* is most similar to *E. eremicus* and *E. tejanus*, which differ in having the radicle only 0.4–0.5× the length of the scape, the first

funicular segment is not as reduced, and the club is not tapered (Figs. 10, 26).

Males of *E. californicus* lack pigment patterns on the mesoscutum, and the scape is 2.5–2.8 × as long as the pedicel. *Eretmocerus eremicus* and *E. tejanus* differ by having distinct fuscous pigment patterns on the mesoscutum (Figs. 30, 33).

Female.—Length and body color could not be accurately determined from available slide-mounted specimens. Wings hyaline.

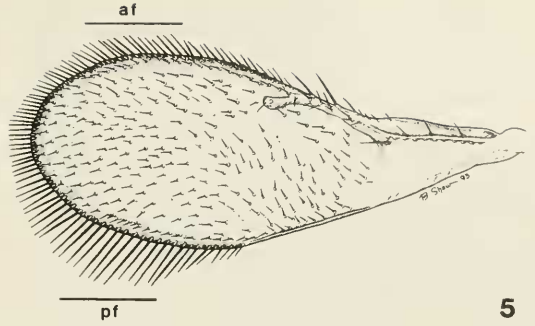
Face and occiput with transverse substri-gulate sculpture, interscrobial area vertically substri-gulate. Antenna (Fig. 4) with radicle 5.4× as long as wide; scape 3.9× as long as wide, 1.5–1.6× length of radicle, 1.6× length of pedicel, 0.5× length of club; pedicel 2.6× as long as wide, slightly shorter than radicle, 0.6× length of scape, 0.3× length of club. Funicle I triangular, 1.2× as wide as long and much smaller than funicle II; funicle II 1.8× as wide as long. Club with apex apically tapered, 5.2–6.6× as long as wide, 2× length of scape, 3.2× length of pedicel. Antennal ratio 1:1.5:1.0:3.1.

Mesoscutum trapezoidal with 6 setae and with reticulate sculpture in the anterior ½, remainder with elongate reticulate sculpture laterally and substri-gulate sculpture medially. Parapsis with 2 setae and faint reticulate to substri-gulate sculpture; axilla with 1 seta and sculpture similar to parapsis. Scutellum with 4 setae and 2 placoid sensilla lateral to and close to posterior setae, laterally with elongate reticulate sculpture, remainder with elongate to substri-gulate sculpture. Propodeum smooth. Endophragma extending to posterior half of gastral tergite II.

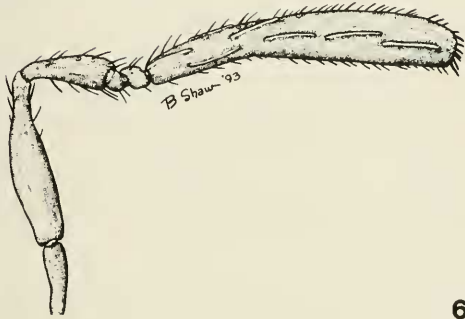
Forewing (Fig. 5) 2.7× as long as wide at width I, 2.4× as long as maximum width of disc. Longest anterior alary fringe 0.2× width of disc, longest posterior alary fringe 0.4× width of disc. Single seta at base of wing present or absent; distal portion of costal cell with 2–5 setae. Marginal vein with 3 long setae, 10–12 setae usually between marginal vein and linea calva. Linea



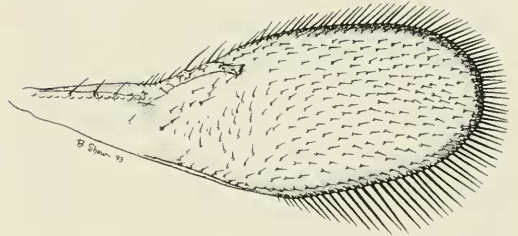
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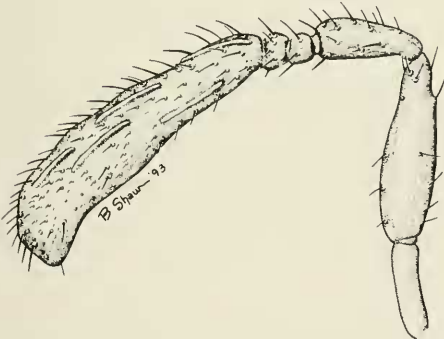
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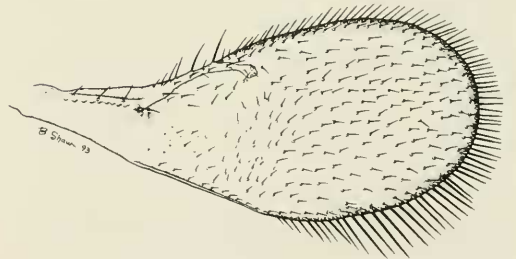
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Figs. 4-9. 4-5, *Eretmocerus californicus*. 4, ♀ antenna. 5, ♀ forewing. 6-7, *E. corni*. 6, ♀ antenna. 7, ♀ forewing. 8-9, *E. debachi*. 8, ♀ antenna. 9, ♀ forewing. af = anterior alary fringe, pf = posterior alary fringe.

calva closed posteriorly by setae, with 12-15 tubercles on ventral surface of wing near posterior end of linea calva; a group of 31-43 setae including those forming distal edge of linea calva point toward anterior margin of wing, remaining 171-175 setae in disc point to distal apex of wing. Ratio of submarginal:marginal:stigmatal veins 2.8:1.1:1.

Hind wing 6.9× as long as wide, with 7-9 setae in center.

Gastral tergite I covered with strong reticulate sculpture; lateral margins of gastral tergites imbricate with dense stippling; gastral tergites I-VI with paired setae as follows: 1, 1, 2, 2-3, 2, 1. Syntergum with 4 setae.

Ovipositor slightly exerted and equal to length of club, $3\times$ length of pedicel, $1.9\times$ length of scape, and $1.1\times$ length of midtibia.

Male.—Body color could not be accurately determined from available slide-mounted specimens. Mid- and hind tarsi I–III fuscous. Marginal and stigmal veins fuscous, base of forewing and costal cell slightly fuscous.

Host.—Reared from an unknown species of *Aleyrodes*.

Discussion.—Howard's original description and figures of *E. californicus* were based on a series of female and male specimens reared from an undetermined *Aleyrodes* collected by D. W. Coquillett in Los Angeles, California, in 1887. Although Howard (1895) deposited type material in the USNM, and Dozier examined the material in 1932, Compere (1936) was unable to examine *E. californicus* and placed it in his key based on the original description. The type material was lost from about 1932 until 1992.

In 1992, G. Evans found the missing slides of *E. californicus* at the USNM. The specimens on one slide (five female, eight male) were crumpled in dark orange balsam and not suitable for study. All the specimens on this slide have been individually remounted in balsam. G. Evans also remounted broken specimens, including one female, from two other slides labelled as USNM Type No. 2699. The label data for these two new slides, which list "*Asterodiaspidis*" as the host, do not agree with the label data from the other type slides. We consider this to be an error.

Our figures and redescription are derived from the six remounted females and eight remounted males, and seven male specimens from a single original Howard slide. There are now a total of 16 slides bearing *E. californicus* specimens labelled with the original collection data and identified as USNM Type No. 2699.

It is interesting to note that *E. californicus* was reared from an unknown species of

Aleyrodes on oak. *Aleuroplatus*, *Tetraleurodes*, and *Trialeurodes* all occur on *Quercus* in southern California. M. Rose and J. B. Woolley (TAMU) were unable to obtain *Eretmocerus* from numerous collections of whitefly, particularly *Tetraleurodes stanfordi* (Bemis), from oaks in Los Angeles County over the past 15 years.

Lack of accurate characterization of *E. californicus* has resulted in misapplication of this name, particularly to species of *Eretmocerus* reared from *Bemisia (tabaci)* complex) in the U.S. We have not examined any specimens of *E. californicus* reared from *Bemisia (tabaci)* complex).

Eretmocerus corni Haldeman
(Figs. 6–7)

Eretmocerus corni Haldeman, 1850: 110
[USNM, examined].

Type Material.—Neotype ♀ mounted in balsam on a slide labelled. "*Eretmocerus corni* Hald./Reared from white-fly, *Asterochiton*/sp. on *Impatiens/biflora*./White Clay Creek/Pa. Sept. 16, 1929/H.L. Dozier" "*Eretmocerus/corni* Hald./Designated as/this long-lost/species./♀ + ♂ Neotype/U.S.N.M."

Diagnosis.—Females of *Eretmocerus corni* can be distinguished by the combination of the elongate club that is $5.9\text{--}7\times$ as long as wide and the relatively short pedicel, which is only $2.4\text{--}3.1\times$ as long as wide, and $0.25\text{--}0.29\times$, rarely $0.30\times$, as long as the club (Fig. 6). *Eretmocerus corni* is similar to *E. eremicus* and *E. tejanus*, which differ in having the pedicel $3\text{--}4\times$ as long as wide and $0.28\text{--}0.39\times$ as long as the club (Figs. 10, 26). *Eretmocerus haldemani* also has an elongate club, but it is $7.5\text{--}8.3\times$ as long as wide (Fig. 16).

Males of *Eretmocerus corni* have the mesoscutum and scutellum fuscous, and the hind tibia is not fuscous. They are most similar to males of *E. eremicus* and *E. tejanus*. Males of *E. eremicus* differ in having the hind tibia fuscous, and males of *E. tejanus* can be distinguished by the longitu-

dinal fuscous bands on the mesoscutum (Fig. 33).

Female.—Length of specimens in Hoyer's 0.47–0.55 mm. Specimens in Hoyer's with body and antennae pale yellow. Head amber; eyes amber with inner red pigment, ocelli pale. Wings hyaline.

Face and occiput with transverse substrigulate sculpture, interscrobial area vertically substrigulate. Antenna (Fig. 6) with radicle $4\times$ as long as wide; scape $4.9\times$ as long as wide and $2.1\times$ length of radicle, $2.2\times$ length of pedicel, $0.4\times$ length of club; pedicel $2.4\text{--}3.1\times$ as long as wide, $0.4\times$ length of scape, $0.25\text{--}0.29\times$, and rarely $0.30\times$, length of club. Funicle I triangular, $1.25\times$ as wide as long; funicle II subquadrate. Club with apex truncate, $5.9\text{--}7\times$ as long as wide, $2.5\times$ length of scape, $4.9\times$ length of pedicel. Antennal ratio 1:2.1:1.6:4.7.

Mesoscutum trapezoidal with 6 setae and reticulate sculpture anteriorly, remainder with elongate reticulate sculpture. Parapsis with 2 setae and reticulate to substrigulate sculpture; axilla with 1 seta and reticulate to substrigulate sculpture. Scutellum with 4 setae and 2 placoid sensilla lateral to and slightly closer to posterior setae than to anterior setae, with fine substrigulate sculpture medially, remainder with reticulate sculpture. Propodeum medially reticulate, faintly reticulate on lateral margins. Endophragma extending nearly to posterior margin of gastral tergite IV.

Forewing (Fig. 7) $2.9\times$ as long as wide at width I, $2.7\times$ as long as maximum width of disc. Longest anterior alary fringe $0.16\times$ width of disc; longest posterior alary fringe $0.3\times$ width of disc. Single seta at base of wing present or absent; distal portion of costal cell usually with 3, occasionally 2–5, setae. Marginal vein with 3 long setae; 10–11 setae, occasionally 10–15, between marginal vein and linea calva. Linea calva closed posteriorly by setae, with 12–16 tubercles on ventral surface of wing near posterior end of linea calva; a group of 32–45 setae including those forming distal edge of linea calva point toward anterior margin of

wing, remaining 183–238 setae in disc point to distal apex of wing. Ratio of submarginal:marginal:stigmatal veins 3:1.3:1.

Hind wing $7.5\times$ as long as wide, with 7–15 setae in center.

Gastral tergite I with faint transverse substrigulate sculpture medially and reticulate sculpture on anterior half of lateral margins; lateral margins of tergites II–VI imbricate with stippling; tergites I–VI usually with paired setae as follows: 1, 1, 2, 2, 2, 1, but occasionally 1, 1–3, 2–3, 2–3, 2, 1. Syntergum with 4 setae.

Ovipositor slightly exerted, $0.8\times$ length of club, $3.4\times$ length of pedicel, $1.8\times$ length of scape, equal in length to midtibia.

Male.—Specimens mounted in balsam with head orange. Apex of scape, pedicel, and multiporous plate sensilla fuscous. Pronotum fuscous. Mesoscutum fuscous, darkest along anterior margin and becoming paler posteriorly; tegula slightly fuscous. Scutellum fuscous, darkest along anterior and posterior margins. Metanotum and propodeum slightly fuscous. Aedeagus slightly fuscous. Fore- and hind tarsi slightly fuscous; distal portion of midtibia and midtarsi I–III fuscous, midtarsus IV less fuscous. Submarginal vein, costal cell, and edges of marginal and stigmatal veins fuscous; base of forewing and venation of hind wing slightly fuscous.

Host.—Reared from *Trialeurodes packardii* (Morrill), the strawberry whitefly.

Discussion.—Haldeman's (1850) original description and figure of the type species, *E. corni*, were based on "Two mutilated specimens" reared from *Tetraleurodes corni* (Haldeman) [= *Aleurodes corni* Haldeman]. Unfortunately, Haldeman did not designate a depository for his specimens. Dozier (1932), who was unable to locate the original material, provided a redescription of the species and designated a neotype female based on a series of specimens (15 ♀, 3 ♂) reared from *Trialeurodes packardii* (Morrill) [as *T. morrilli* (Britton)] and an additional field-collected female.

The slide labelled as the neotype lists

"*Asterochiton*" as the host, but Dozier only mentions *Trialeurodes morrilli* as a host in the redescription. Mound and Halsey (1978) do not list any species of *Asterochiton* in the U.S. Dozier's original identification of the host is probably an error. Although Dozier stated the slide bearing the neotype female also contained one additional female and one male specimen, the slide with the red USNM type label only has a single female and single male. Despite these discrepancies, we accept this slide with the red USNM type label as the one with the neotype.

Eretmocerus corni did not successfully reproduce on *Bemisia (tabaci)* complex in limited trials at TAMU. It may prove to be important in the biological control of species of *Trialeurodes*.

Other material examined.—**USA: Maryland:** Blackwater Refuge, reared from *T. packardi* on wild strawberry, 19.x, 24, 26.x.1942, H. L. Dozier (1 ♀, 2 ♂, USNM); Cambridge, 24, 26, 30.viii., 9.ix.1943, Ex. *Trialeurodes* on *Euphorbia hirsuta*, H. L. Dozier (1 ♀, 6 ♂, USNM); Church Creek, Ex. *Trialeurodes* on Lizard's Tail, 2, 4.x.1942 (1 ♀, 1 ♂, USNM); Church Creek, Ex. Lizard's Tail, 10.x.1942 (1 ♀, USNM); **New York:** Ithaca, Cornell Plantations, 29.ix.1992, *Trialeurodes packardi* on *Impatiens pallida*, T92047, G. W. Ferrentino (8 ♀, 4 ♂, MJR); Ithaca, S. of Beebe Lake, 10.viii.1988, ex. *Trialeurodes packardi*, M. Hunter (1 ♂, MJR).

Eretmocerus debachi Rose and Rosen
(Figs. 8–9, 29)

Eretmocerus debachi Rose and Rosen,
1991–1992: 200 [USNM, examined].

Type material.—Holotype ♀ mounted in balsam on a slide labelled, "Name Eretmocerus ♀/debachi/Holotype sp.nov./Balsam/Det Rose 1982/Coll M. Rose/No. B2.76/Corr. USNM/Rose&Rosen 91–92" "Loc Rancho Mission/Viejo, Orange Co., Cal./Date VII.15 1982/Host Parabemisia/

myricae/Det Rose 1982/On Valencia orange/and lemons".

There are five ♀ and one ♂ paratypes with the same label data as the holotype. These are deposited with the BMNH, HU, MJR, TAMU, and USNM.

Diagnosis.—Females of *E. debachi* can be distinguished by the deflexed apex of the club (Fig. 8), mesoscutum with 4 setae, and each parapsis with 2 setae. It is most similar to *E. furuhashii*, which differs in having a longer club (Fig. 13) and 3 setae on each parapsis (Fig. 15). *Eretmocerus joeballi* can have the apex of the club slightly deflexed (Fig. 18) but differs in having 6 setae on the mesoscutum.

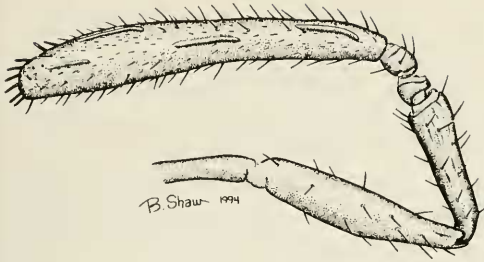
Males of *E. debachi* have each parapsis with 2 setae, a fuscous "T" shape on the mesoscutum, and the scutellum is completely fuscous (Fig. 29). Males of *E. furuhashii* differ in having each parapsis with 3 setae, a very light fuscous "T" shape on the mesoscutum, and the lateral areas of the scutellum are unpigmented (Fig. 31).

Host.—Reared from *Parabemisia myricae* (Kuwana), the bayberry whitefly.

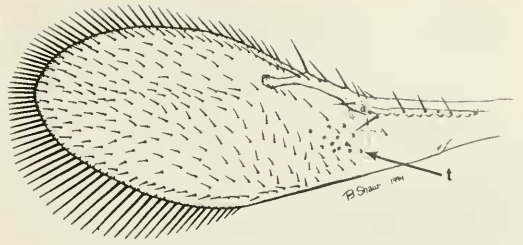
Discussion.—The description of *E. debachi* was based on series of specimens reared from *Parabemisia myricae* collected on citrus in southern California. The taxonomy, biology and history of *E. debachi* in California is well documented (Rose and DeBach 1991–1992, Rose and Rosen 1991–92, Rose and Zolnerowich 1994). This species has been introduced and established in Israel and Turkey, where it is responsible for control of *P. myricae*. Introductions are planned for Spain and France (J. C. Onillon, personal communication) and Morocco (D. Rosen, personal communication).

Eretmocerus eremicus Rose and
Zolnerowich, new species
(Figs. 10–12, 30)

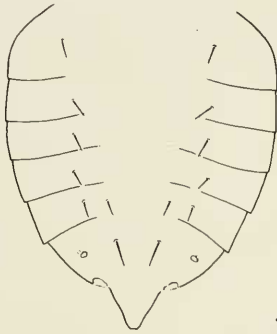
Diagnosis.—Females of *E. eremicus* can be distinguished by the club that is 6.5–7.3× as long as wide (Fig. 10), pedicel that is 3–4× as long as wide and 0.3–0.39× as



10



11



12

Figs. 10–12. *Eretmocerus eremicus*. 10, ♀ antenna. 11, ♀ forewing. 12, ♀ gaster. t = tubercle.

long as the club, mesoscutum with 6 setae, and gastral tergite II usually with 1 pair, but occasionally 2 pairs, of lateral setae (Fig. 12).

Females of *E. eremicus* are very similar to *E. corni* and *E. tejanus*. Females of *E. corni* have the pedicel $2.4\text{--}3.1\times$ as long as wide and $0.25\text{--}0.30\times$ as long as the club, and have not been reliably recorded from *Bemisia (tabaci)* complex). *Eretmocerus tejanus* has the anterior alary fringe of the forewing slightly shorter (Fig. 27), and gastral tergite II usually has 2 pairs, but occasionally 1 pair, of lateral setae (Fig. 28).

Males of *E. eremicus* have the mesoscutum fuscous along the anterior margin (Fig. 30), or with a light fuscous “T” shape (as in Fig. 31), or evenly fuscous, and the hind tibia is fuscous. Males of *E. corni* do not have the hind tibia fuscous, and males of *E. tejanus* can be distinguished by the

longitudinal fuscous bands on the mesocutum (Fig. 33).

Female.—Length of critical point-dried specimens $0.45\text{--}0.55$ mm. Body light yellow. Head light yellow or yellow white and paler than body; eyes grey green, ocelli red. Scape same color as face, pedicel and flagellum slightly darker. Legs pale yellow and paler than body, tarsal claws dark. Wings hyaline.

Specimens mounted in Hoyer’s with body and legs pale yellow amber, legs occasionally slightly darker than body. Head pale to light amber. Antenna pale amber. Wing venation and frenal fold of forewing amber.

Face and occiput with transverse substrigulate sculpture, interscrobular area vertically substrigulate. Antenna (Fig. 10) with radicle $4.2\times$ as long as wide; scape $5.1\times$ as long as wide, $2.1\times$ length of radicle, $1.6\times$

length of pedicel, $0.6\times$ length of club; pedicel 3–4 \times as long as wide, $1.3\times$ length of radicle, $0.6\times$ length of scape, $0.3\text{--}0.39\times$ length of club. Funicle I triangular, $1.1\times$ as wide as long; funicle II $1.1\times$ as long as wide. Club 6.5–7.3 \times as long as wide, $1.7\times$ length of scape, $2.6\times$ length of pedicel. Antennal ratio 1:2.1:1.3:3.5.

Mesoscutum trapezoidal and with 6 setae, occasionally with supernumary setae, anterior $\frac{1}{3}\text{--}\frac{1}{2}$ with reticulate sculpture, medially with substrigulate sculpture, remainder with elongate reticulate sculpture. Parapsis with 2 setae and substrigulate sculpture; axilla with 1 seta and substrigulate sculpture. Scutellum with 4 setae and 2 placoid sensilla lateral to and closer to posterior setae or equidistant, with substrigulate sculpture in median area, remainder with elongate reticulate sculpture. Propodeum with substrigulate sculpture. Endophragma extending to posterior half of gastral tergite IV.

Forewing (Fig. 11) $2.9\times$ as long as wide at width I, $2.7\times$ as long as maximum width of disc. Longest anterior alary fringe $0.17\times$ width of disc, longest posterior alary fringe $0.35\times$ width of disc. Base of wing usually with 1, occasionally 0–2, setae, distal portion of costal cell usually with 2–3 setae. Marginal vein with 3 long setae, 6–12 setae between marginal vein and linea calva. Linea calva closed posteriorly by setae, with 11–14 tubercles on ventral surface of wing near posterior end of linea calva; a group of 24–35 setae including those forming distal edge of linea calva point toward anterior margin of wing, remaining 120–202 setae in disc point to distal apex of wing. Ratio of submarginal:marginal:stigmatal veins 3.5:1.5:1.

Hind wing $6.9\times$ as long as wide and with 5–11 setae in center.

Gastral tergite I with strong substrigulate sculpture anterolaterally, remainder substrigulate; lateral margins of tergites faintly imbricate with stippling; gastral tergites I–IV (Fig. 12) usually with paired setae as fol-

lows: 1, 1, 1, 1, 2, 1, but can be 1, 1–2, 1–2, 1–2, 2, 1. Syntergum with 4 setae.

Ovipositor slightly exerted, equal in length to club, $2.6\times$ length of pedicel, $1.7\times$ length of scape, equal in length to midtibia.

Male.—Length of critical point-dried specimens 0.43–0.51 mm. Face light yellow, vertex orange yellow, eyes grey green, ocelli red. Scape same color as face or slightly darker, pedicel and flagellum testaceous. Pronotum dorsolaterally brown. Mesoscutum orange yellow to orange brown and fuscous along anterior margin (Fig. 30), or with a light fuscous “T” shape (as in Fig. 31), or evenly fuscous; parapsis lighter. Scutellum colored as mesoscutum. Dorsellum brown. Propodeum light brown dorsally. Gaster yellow brown to orange brown dorsally, remainder yellow. Coxae pale whitish, proximal $\frac{1}{3}\text{--}\frac{1}{2}$ of all femora pale white, remainder tan to light brown, all tibiae light brown, all tarsi brown.

Specimens mounted in Hoyer’s with head dark amber. Radicle and scape fuscous; pedicel darker, club slightly fuscous and darker at the base, multiporous plate sensilla dark fuscous. Pronotum fuscous. Mesoscutum fuscous along anterior margin (Fig. 30), or with a light fuscous “T” shape (as in Fig. 31), or evenly fuscous; parapsis and axilla occasionally slightly fuscous. Scutellum usually fuscous, darkest along anterior and posterior margins. Metanotum medially fuscous. Propodeum fuscous, darker along lateral margins. Gastral tergites slightly fuscous. Aedeagus fuscous. Foreleg beyond coxa fuscous, tibia darkest; midleg beyond coxa fuscous, tarsi I–III darkest; hind leg beyond coxa fuscous, tarsi IV lighter than proximal tarsi. Base of forewing and costal cell slightly fuscous; venation of fore- and hind wings fuscous.

Host.—Reared from *Bemisia* (*tabaci* complex) and possibly *Trialeurodes*. Specimens have been reared from mixed hosts of *Bemisia* and *Trialeurodes*, with the latter most likely *T. abutiloneus* (Haldeman), the bandedwinged whitefly, or *T. vaporariorum* (Westwood), the greenhouse whitefly.

Discussion.—This species has been referred to as *E. californicus*, *E. sp. nr. californicus*, and *E. haldemani*. Although females of *E. eremicus* are extremely similar to those of *E. tejanus*, differences in male pigment patterns, in conjunction with reciprocal mating tests and electrophoretic analysis between populations from Arizona and California, and Texas (Hunter et al. 1996), indicate that the Arizona and California populations form a species distinct from the population in Texas.

Eretmocerus eremicus is the most common naturally occurring parasite of *Bemisia* (*tabaci* complex) in the desert areas of Arizona and California. This species possibly parasitizes *Trialeurodes abutiloneus* (Haldeman), which can be sympatric with *Bemisia* in those areas. Headrick et al. (1995, 1996) described the behavior of *E. eremicus*.

Etymology.—From Latin *eremicus*, meaning “of the desert”.

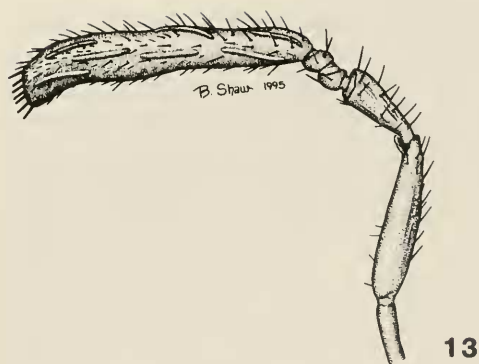
Holotype.—♀ mounted in balsam on a slide labelled, “Loc Phoenix/Arizona/Date III 1991/Host Bemisia/tabaci/Det GB 1991/On Gossypium/hirsutum” “Name Eretmocerus/♀/spm 1/?USNM/Det Rose 1991/Coll G. Butler/No. GB-3/Corr. Rose/Noyes 91”.

Deposited in USNM.

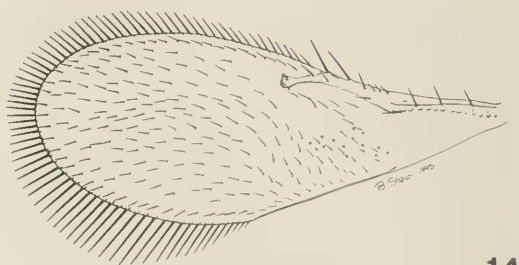
Paratypes.—USA: same data as holotype (3 ♀ and 3 ♂ mounted in balsam, 19 ♀ and 7 ♂ mounted in Hoyer’s); Texas, Hidalgo Co., Mission Biological Control Laboratory, F₃ lab culture, M94001, original material: USA: California, Imperial Co., Brawley, K. Hoelmer, 6.i.1994, ex: *Bemisia tabaci*, on: okra (4 ♀ and 2 ♂ mounted in balsam, 7 ♀ and 4 ♂ card-mounted). Paratypes deposited with BMNH, MJR, TAMU, UCR, and USNM.

Other specimens examined.—USA: Arizona: Maricopa Co., Phoenix, greenhouse, 23.iv.1992, *Bemisia tabaci* on collards, O. Minkenberg (2 ♀, 5 ♂); Pima Co., Tucson, 21.x.1991, *Bemisia tabaci* on cotton, O. Minkenberg (10 ♀, 10 ♂); Tucson, greenhouse, 11.vi.1993, *Bemisia* sp. on pointsetia, O. Minkenberg (6 ♀, 13 ♂); Califor-

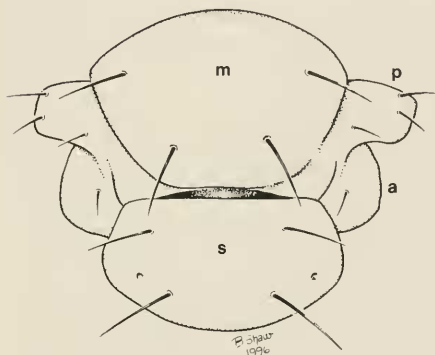
nia: Imperial Co., 16.xi.1992, *Bemisia* sp., T. Perring (2 ♀, 3 ♂, UCR); Bard, 7.vi.1993, *Bemisia* sp. on *Cucurbita* sp., K. Hoelmer (16 ♀, 13 ♂); Brawley, 29.xi.1982, *Bemisia tabaci*, cotton, Kramer & Forrester (11 ♀, 7 ♂); Brawley, 8.v.1982, *Bemisia* & *Trialeurodes* on lantana, G. Butler (16 ♀, 12 ♂); Brawley, 21.viii.1982, *Bemisia tabaci* on cotton, Rose (10 ♀, 10 ♂); Brawley, 29.xi.1983, *Bemisia tabaci*, cotton, Kramer & Forrester (5 ♀, 2 ♂); Brawley, 23.x.1984, *Bemisia tabaci*, bindweed, D. Meyerdirk (19 ♀, 3 ♂); Brawley, USDA, 13.ix.1993, kenaf, Rose & Pickett (5 ♀, 4 ♂); Brawley, 8.v.1995, *Bemisia argentifolii* on melon in refuge, M. Rose (10 ♀); Brawley, Legion Rd./Hwy. 86, 11.i.1995, W. Roltsch, *Bemisia argentifolii* on kenaf (19 ♀, 1 ♂); Brawley, Legion Rd./Hwy. 86, 20.iv.1995, *Bemisia argentifolii* on eggplant, W. Roltsch (18 ♀); Brawley, Legion Rd./Hwy. 86, 18.v.1995, W. Roltsch, *Bemisia argentifolii* on cantaloupe (3 ♀); Brawley, Legion Rd./Hwy. 86, 22.v.1995, *Bemisia argentifolii* on sunflower, W. Roltsch (14 ♀, 1 ♂); Brawley, Legion Rd./Hwy. 86, 13.vi.1995, W. Roltsch, *Bemisia argentifolii* on collard (14 ♀, 1 ♂); Brawley, Legion Rd./Hwy. 86, 19.vii.1995, W. Roltsch, *Bemisia argentifolii* on cotton (9 ♀); Brawley, Legion Rd./Hwy. 86, 21.viii.1995, W. Roltsch, *Bemisia argentifolii* on cotton (24 ♀); El Centro, Desert Trails RV Park, 1.ii.1993, *Bemisia* on cotton, M. Rose (3 ♀, 1 ♂); El Centro, Desert Trails RV Park, 1.ii.1993, *Bemisia* on *Hibiscus*, Rose & Pickett (12 ♀, 11 ♂); Holtville, 13.ix.1993, *Bemisia* on sunflower, M. Rose (32 ♀, 105 ♂); nr. Holtville, CDFABornt’s, 13.ix.1993, *Bemisia* on sunflower, Rose, Pickett, & Roltsch (33 ♀, 18 ♂); Kern Co., Bakersfield, 8.x.1992, *Trialeurodes abutilonea?* on cotton, J. Ball (2 ♀); Bakersfield, 1.ix.1993, *Bemisia tabaci* on eggplant, J. Ball (1 ♀); Bakersfield, 1.x.1993, *Bemisia tabaci* on lantana, J. Ball (1 ♀, 1 ♂); Bakersfield, 29.vi.1994, *Bemisia* on lantana, J. C. Ball (3 ♀); Bakersfield, 16.viii.1994, *Bemisia* on lantana, J. Ball (6



13



14



15

Figs. 13–15. *Eretmocerus furuhashii*. 13, ♀ antenna. 14, ♀ forewing. 15, ♀ mesonotum. a = axilla, m = mesoscutum, p = parapsis, s = scutellum.

♀, 8 ♂); Bakersfield, 17.viii.1994, *Bemisia* on okra, J. Ball (6 ♀, 2 ♂); Bakersfield, 7.ix.1994, *Bemisia* on fruitless mulberry, J. Ball (2 ♀, 1 ♂); Bakersfield, 8.ix.1994, *Bemisia* on lantana, Joe Ball (1 ♂). All specimens from MJR unless noted otherwise.

Eretmocerus furuhashii Rose and
Zolnerowich
(Figs. 13–15, 31)

Eretmocerus furuhashii Rose and Zolnerowich, 1994: 286 [NSM, examined]

Type material.—Holotype ♀ mounted in balsam on a slide labelled, “Name *Eretmocerus/furuhashii*/sp.nov./Det 19/Coll M. Rose/No./Corr.” “Loc Japan:/Shizuoka, Kochi/Date VIII.1979/Host *Parabemisia/myricae* (Kuwana)/Det 19/On *Morus*.”

There are an additional 198 paratypes from a number of localities in California and Japan mounted in balsam and Hoyer’s

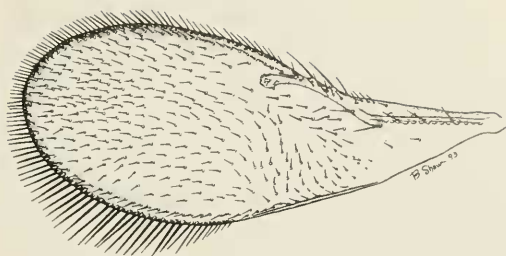
on a number of slides. These are deposited with BMNH, HU, MJR, NSM, TAMU, and USNM.

Diagnosis.—Females of *E. furuhashii* can be distinguished by the deflexed apex of the club (Fig. 13), mesoscutum with 4 setae, and each parapsis with 3 setae (Fig. 15). It is most similar to *E. debachi*, which differs in having a shorter club (Fig. 8) and only 2 setae on each parapsis. *Eretmocerus joeballi* can have the apex of the club slightly deflexed (Fig. 18) but differs in having 6 setae on the mesoscutum.

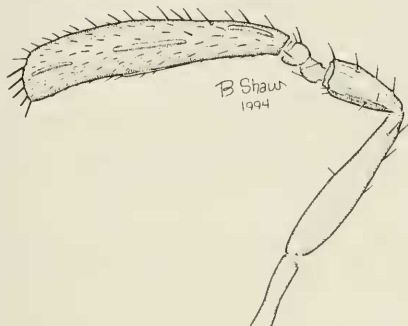
Males of *E. furuhashii* have each parapsis with 3 setae, a light fuscous “T” shape on the mesoscutum, and the lateral areas of the scutellum are unpigmented (Fig. 31). Males of *E. debachi* differ in having each parapsis with 2 setae, a dark fuscous “T” shape on the mesoscutum, and the scutellum is completely fuscous (Fig. 29).



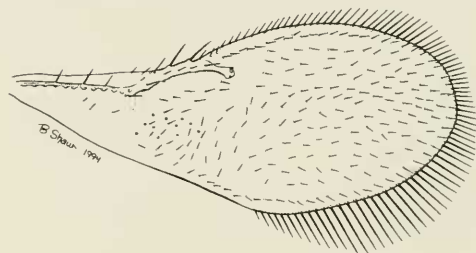
16



17



18



19

Figs. 16–19. *Eretmocerus haldemani*. 16, ♀ antenna. 17, ♀ forewing. 18–19, *E. joeballi*. 18, ♀ antenna. 19, ♀ forewing.

Host.—Reared from *Parabemisia myricae*, the bayberry whitefly.

Discussion.—The description of *E. furuhashii* was based on specimens reared from *Parabemisia myricae* collected on mulberry in Japan and citrus in southern California (Rose and Zolnerowich 1994). This species was introduced to California in 1979 and was established in citrus groves in Orange, Riverside, and Ventura counties prior to the rapid distribution of *E. debachi* (Rose and DeBach 1991–1992). No recent evidence of *E. furuhashii* has been found in southern California, but displacement may not be complete in all areas of citriculture.

Eretmocerus haldemani Howard
(Figs. 16–17)

Eretmocerus haldemani Howard, 1908: 65
[USNM, examined].

Type material.—Lectotype here designated, ♀ mounted in balsam on a slide la-

belled, “Morrill No. 509/? holotype/Type/No. 11708/U.S.N.M.” “*Eretmocerus* n.sp./♀/*haldemani*/How.”

An additional slide bears two ♂ specimens, labelled “Morrill No. 509/Type/NO. 11708/U.S.N.M.” “*Eretmocerus*/nsp. ♂/*haldemani* How.” These are designated as paralectotypes.

Diagnosis.—Females of *E. haldemani* can be distinguished by the extremely elongate club that is 7.5–8.3× as long as wide (Fig. 16), the elongate scape that is 6.9× as long as wide, and the elongate midbasitarsus that is 8.5× as long as wide. It is most similar to *E. corni*, which has an elongate club that is only 5.9–7× as long as wide, and the scape is only 4.9× as long as wide (Fig. 6).

Males of *Eretmocerus haldemani* are very similar to those of *E. illinoisensis*. Males of these species cannot be diagnosed or separated based on the poor condition of specimens available for study.

Female.—Length, body color, sculpture, and setation could not be accurately determined from the available slide-mounted specimen. Wings hyaline.

Antenna (Fig. 16) with radicle $4.2\times$ as long as wide; scape $6.9\times$ as long as wide, $2.5\times$ length of radicle, $1.8\times$ length of pedicel, $0.6\times$ length of club; pedicel $3.6\times$ as long as wide, $1.4\times$ length of radicle; $0.5\times$ length of scape, $0.3\times$ length of club. Funicle I triangular, $1.2\times$ as long as wide; funicle II subquadrate. Club elongate, apex truncate, $7.5\text{--}8.3\times$ as long as wide, $1.7\times$ length of scape, $3.2\times$ length of pedicel. Antennal ratio 1:2.5:1.3:4.4.

Mesoscutum trapezoidal and with 6 setae. Parapsis with 2 setae; axilla with 1 seta. Scutellum with 4 setae and 2 placoid sensilla lateral to and closer to posterior setae than anterior setae.

Forewing (Fig. 17) $2.7\times$ as long as wide at width 1, $2.4\times$ as long as maximum width of disc. Longest anterior alary fringe $0.09\times$ width of disc, longest posterior alary fringe $0.25\times$ width of disc. Base of wing with 1–2 setae, distal portion of costal cell with 4–5 setae. Marginal vein with 3 long setae, 14–16 setae between marginal vein and linea calva. Linea calva closed posteriorly by setae, with 16 tubercles on ventral surface of wing near posterior end of linea calva; a group of 44–48 setae including those forming distal edge of linea calva point toward anterior margin of wing, remaining 221 setae in disc point to distal apex of wing. Ratio of submarginal:marginal:stigmatal veins 2.4:1:1.

Hind wing $7\times$ as long as wide, with 13–14 setae in center.

Male.—Body color could not be accurately determined from available slide-mounted specimens. Foretarsi and mid- and hind tarsi IV slightly fuscous; mid- and hind tarsi I–III fuscous. Base of costal cell and venation of forewing fuscous.

Host.—Reared from *Aleuroplatus coronata* (Quaintance), the crown whitefly.

Discussion.—Howard (1908) described *E. haldemani* from one female and one

male reared from *Aleuroplatus coronata* (Quaintance) collected by E. M. Ehrhorn in Berkeley, California. No collection dates are given in the literature or on the type slides. Although Howard stated that he described this species from one female and one male, the two slides bearing red USNM type labels bear one female and two males, respectively. Despite this discrepancy we accept the slides with the USNM type labels as being Howard's type specimens. No host plant was recorded, but *A. coronata* is common on *Quercus* in northern California.

Numerous specimens of *Eretmocerus* held in collections in the U.S. and abroad have been erroneously identified as *E. haldemani*. M. Rose, K. Hoelmer (USDA/APHIS), and C. Pickett and R. Gill (CDFA) have made numerous unsuccessful attempts over the past 15 years to rear specimens of *Eretmocerus* from *Aleuroplatus coronata* collected on oaks in Berkeley, California.

Eretmocerus illinoisensis Dozier

Eretmocerus illinoisensis Dozier, 1932: 114 [INHS, examined].

Type material.—Holotype δ mounted in balsam on a slide labelled "Eretmocerus/illinoisensis/ δ Dozier/Swept from veg-/etation in bed of/creek./Elizabethtown, Ill./Aug. 5-1932/H.L. Dozier" "Eretmocerus/illinoisensis/Dozier/SL.12934 I.N.H.S./Type No." "HOLOTYPE/Eretmocerus/illinoisensis/DOZIER" [on underside of slide].

There are two additional δ paratype slides labelled "Eretmocerus/illinoisensis/ δ Dozier/Swept from veg-/etation in bed of/creek./Mounted in Euparal/Elizabethtown, Ill./Aug. 5-1932/H.L. Dozier" "Eretmocerus/illinoisensis/Dozier/SL. 12935/Paratype δ I.N.H.S./No." "PARATYPE/Eretmocerus/illinoisensis/DOZIER" [on underside of slide], and "Eretmocerus/illinoisensis/ δ Dozier/Swept from veg-/etation in bed of/creek./Elizabethtown, Ill./Aug. 5-1932/H.L. Dozier" "Eretmocerus/illinoisensis/Dozier/Paratype δ /No. U.S.N.M."

Discussion.—Dozier's (1932) description of *E. illinoisensis* was based on a series of six male specimens collected by sweeping weeds and grasses in a creek bed near Elizabethtown, Illinois. We were able to locate only the holotype and two paratypes. Females are unknown, and Compere (1936) was unable to include this species in his key. As there are no host records, future association with female specimens is problematic. *Eretmocerus illinoisensis* is very similar to males of *E. haldemani* and cannot be diagnosed or separated based on the poor condition of specimens available for study.

***Eretmocerus joeballi* Rose and
Zolnerowich, new species**

(Figs. 18–19)

Diagnosis.—Females of *E. joeballi* can be distinguished by the slightly deflexed apex of the club (Fig. 18), 6 setae on the mesoscutum, and the ovipositor is 1.5× the length of the club and 1.3× the length of the midtibia. It is most similar to *Eretmocerus debachi* and *E. furuhashii*, which differ by having only 4 setae on the mesoscutum (Fig. 15).

Female.—Length of specimens mounted in Hoyer's 0.7–0.74 mm. Specimens in Hoyer's with head, body, and legs pale yellow. Portions of body with pupal exuviae attached are gold orange. Wings hyaline.

Antenna (Fig. 18) with radicle 3.8× as long as wide; scape 4.5× as long as wide, 2.1× length of radicle, 1.6× length of pedicel, 0.6× length of club; pedicel 2.0–2.3× as long as wide, equal in length to radicle; 0.5× length of scape, 0.3× length of club. Funicle I triangular, 1.2× as wide as long; funicle II 1.4× as wide as long. Club with apex slightly deflexed, 4.5–5.1× as long as wide, 1.6× length of scape, 3.2× length of pedicel. Antennal ratio 1:2.1:1:3.2.

Mesoscutum trapezoidal and with 6 setae, anterior 1/3 with strong reticulate sculpture, medially with substrigulate sculpture, laterally with elongate reticulate sculpture. Parapsis with 2 setae and strong substrigulate

sculpture; axilla with 1 seta and substrigulate sculpture. Scutellum with 4 setae and 2 placoid sensilla lateral to and closer to posterior setae, with substrigulate sculpture, laterally with elongate reticulate sculpture. Propodeum with faint substrigulate sculpture medially, substrigulate sculpture stronger around lateral margins. Endophragma extending to posterior margin of gastral tergite II.

Forewing (Fig. 19) 2.7× as long as wide at width I, 2.4× as long as maximum width of disc. Longest anterior alary fringe 0.14× width of disc, longest posterior alary fringe 0.3× width of disc. Base of wing usually with 2–3 setae, distal portion of costal cell with 2 setae. Marginal vein with 3 long setae, 7–13 setae between marginal vein and linea calva. Linea calva closed posteriorly by setae, with 11–14 tubercles on ventral surface of wing near posterior end of linea calva; a group of 22–27 setae including those forming distal edge of linea calva point toward anterior margin of wing, remaining 87–149 setae in disc point to distal apex of wing. Ratio of submarginal:marginal:stigmatal veins 2.8:1.2:1.

Hind wing 6.7× as long as wide and with 1–4 setae in the center.

Gastral tergite I with substrigulate sculpture, lateral margins with broad imbricate sculpture and with stippling; gastral tergites I–VI with paired setae as follows: 1, 1, 1, 2, 2, 1. Syntergum with 4–6 setae.

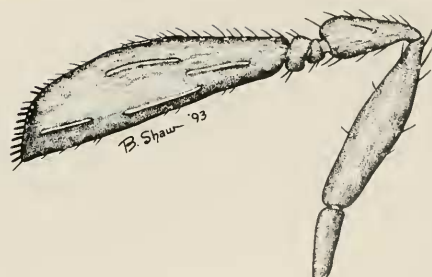
Ovipositor slightly exerted and 1.5× length of club, 4.6× length of pedicel, 2.3× length of scape, 1.3× length of midtibia.

Male.—Unknown.

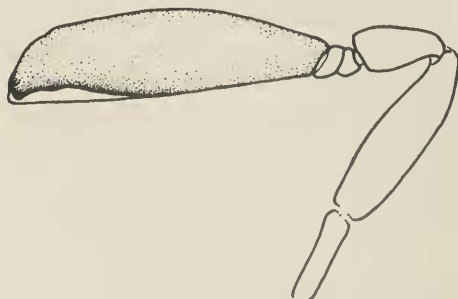
Host.—Reared from *Bemisia (tabaci)* complex).

Discussion.—This uncommon species has been recovered from *Bemisia (tabaci)* complex) on *Morus* and *Solanum* in Kern County, California. *Eretmocerus eremicus* occurs in the same area.

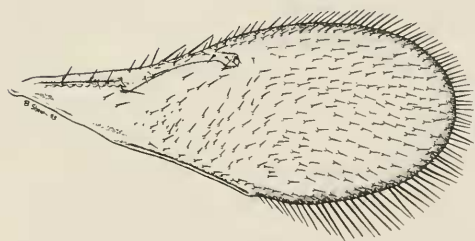
Etymology.—Named in honor of Joe Ball, who collected the described specimens and has contributed to biological con-



20



21



22

Figs. 20–22. *Eretmocerus portoricensis*. 20, ♀ antenna. 21, ♀ antenna with artifactual “parrot beak” club. 22, ♀ forewing.

tol by natural enemies in California for more than 35 years.

Holotype.—♀ mounted in Hoyer’s on a slide labelled, “Name *Eretmocerus x/joeballi* Rose +/Zolnerowich 96/2 ♀♀/Det. Rose+Zoln. 1995/Coll. J. C. Ball/No. 93-XI 22/Corr.” “Loc Bakersfield, CA/Kern Co./Date Oct. 1 1993/Host *Bemisia tabaci*/Det 19/On Mulberry?” There are two ♀ mounted on this slide. The holotype is the uppermost specimen and delimited by red ink. The second specimen on the slide is designated as a paratype. Deposited in USNM.

Paratypes.—**USA:** same data as holotype (2 ♀ mounted in Hoyer’s); **California:** Kern Co., Bakersfield, 1.ix.1993, *Bemisia tabaci* on nightshade (1 ♀ mounted in Hoyer’s); Bakersfield, 7.ix.1994, *Bemisia* on fruitless mulberry, J. Ball (1 ♀ mounted in Hoyer’s). Paratypes deposited with MJR and TAMU.

Eretmocerus portoricensis Dozier
(Figs. 20–22)

Eretmocerus portoricensis Dozier, 1932: 115 [USNM, examined].

Type material.—Lectotype here designated, ♀ mounted in Hoyer’s on a slide labelled, “*Eretmocerus/portoricensis/Dozier/* Reared from *Aleu-/rothrixus flocco-/sus* on “Almacigo”/Bayamon, P Rico/Jan. 21-1925/H.L. Dozier” “*Eretmocerus/portoricensis/Dozier/♀/Type*. No. 44825 U.S.N.M.” There are 13 ♀ specimens mounted on the slide. The lectotype is the specimen closest to the bottom of the slide, and faces the top edge of the slide. It is partially circled with black ink. The remaining specimens on the slide are designated as paralectotypes.

An additional slide labelled “*Eretmocerus/californicus* How./det Gahan/Reared from/*Aleurothrixus/floccosus* Mask./on Almacigo/Bayamon, P.R./Jan. 21-1925/H. L.

Dozier" "*Eretmocerus/portoricensis*/Dozier/Para//Type No. 44825 U.S.N.M." has 19 ♀ specimens mounted on it. These are also designated as paralectotypes.

We are unable to locate the other four slides that Dozier cited in his original description.

Diagnosis.—Females of *E. portoricensis* can be distinguished by the shape of the club, which is strongly convex dorsally and straight ventrally (Fig. 20). The shape of this club is unlike that of any other described species in the U.S.

Female.—Length of specimens mounted in Hoyer's 0.75–0.89 mm. Type series mounted in balsam with body yellow, legs slightly paler. Specimens in Hoyer's with body pale yellow. Wings hyaline.

Face and occiput with transverse substri-gulate sculpture, lower face with substri-gulate sculpture curving downward, inter-scrobal area vertically substri-gulate. Antenna (Fig. 20) with radicle 3.8× as long as wide; scape 3.5× as long as wide, 2.1× length of radicle and pedicel, 0.7× length of club; pedicel 2.2× as long as wide, equal in length to radicle, 0.5× length of scape, 0.3× length of club. Funicle I triangular, as wide as long; funicle II 1.6× as wide as long. Club with apex curved, 3.2–3.8× as long as wide, 1.5× length of scape, 3.1× length of pedicel. Antennal ratio 1:2.1:1:3.1.

Mesoscutum trapezoidal and with 6 setae, anterior ¼ with reticulate sculpture, laterally with faint elongate reticulate sculpture, remainder with substri-gulate sculpture. Parapsis with 2 setae and faint reticulate to substri-gulate sculpture along lateral margins; axilla with 1 seta and sculpture similar to parapsis. Scutellum with 4 setae and 2 placoid sensilla lateral to and closer to posterior setae, with substri-gulate sculpture medially and reticulate sculpture laterally. Propodeum with transverse striations medially and reticulate sculpture laterally. Endophragma broad, extending from posterior ¼ of gastral tergite I to anterior margin of gastral tergite II.

Forewing (Fig. 22) 2.7× as long as wide at width I, 2.3× as long as maximum width of disc. Longest anterior alary fringe 0.1× width of disc, longest posterior alary fringe 0.2× width of disc. Base of wing usually with 2 setae, occasionally 1–3, often with 1 seta enlarged and reaching submarginal vein, distal portion of costal cell usually with 2–3, occasionally 1–4, setae. Marginal vein with 3 long setae, 10–13 setae between marginal vein and linea calva. Linea calva closed posteriorly by setae, with 10–16 tubercles on ventral surface of wing near posterior end of linea calva; a group of 18–30 setae including those forming distal edge of linea calva point toward anterior margin of wing, remaining 139–191 setae in disc point to distal apex of wing. Ratio of sub-marginal:marginal:stigmatal veins 3:1.3:1.

Hind-wing 6.9× as long as wide and with 0–2 setae in center.

Gastral tergite I reticulate anteriorly and anterolaterally; lateral margins of tergites imbricate with rows of stippling; tergites I–VI with paired setae as follows: 1, 1–2, 1–2, 1–2, 2–4, 2–4. Syntergum with 4 setae.

Ovipositor slightly exerted, 1.2× length of club, 3.6× length of pedicel, 1.7× length of scape, equal in length to midtibia.

Male.—Unknown.

Host.—Reared from *Aleurothrixus floccosus* (Maskell), the woolly whitefly.

Discussion.—Dozier's description was based on a series of 45 female specimens on three slides reared from *Aleurothrixus floccosus* (Maskell) on *Bursera* (= *Elaphrium*) *simaruba* (L.) taken at Bayamon, Puerto Rico, and 18 female specimens on three slides reared from *A. floccosus* on *Guaia-cum* (= *Guajacum*) *officinale* L. collected at Central Aguire, Puerto Rico.

Gahan originally identified Dozier's specimens as *E. californicus* in 1925. Dozier (1932) later compared his specimens from *A. floccosus* with the type material of *E. californicus* at the USNM and concluded the species were distinct. The antennal club of *E. portoricensis* was described with "the

apex shaped somewhat like a parrot's beak", but this distinctive shape is artificial. The apex of the club is a blunt curve, but the shriveled contents of the club can withdraw from the cuticle to create a beaked appearance (Fig. 21). This artifact has not been observed in other species.

Eretmocerus portoricensis has been reared from *A. floccosus* collected on citrus in Peru. This material probably resulted from the importation of parasites of *A. floccosus* from Florida in 1957 (Ebeling 1957).

Other specimens examined.—**USA:**
Florida: Broward Co., Fort Lauderdale, ix.10.80, *Aleurothrixus floccosus* on citrus, R. Dowell, No. R80-52 (13 ♀); Fort Lauderdale, 1982, *Aleurothrixus floccosus*, C. R. Thompson (7 ♀); Hollywood, ii.2.80, *Aleurothrixus floccosus* on citrus, Wm. Gregory., No. R80-1-2, No. R80-1-3 (21 ♀); Hollywood, viii.31.81, *Aleurothrixus floccosus* on citrus, Wm. Gregory, No. R81-45 (6 ♀); Oakland Park, i.3.80, *Aleurothrixus floccosus* on citrus, B. Gregory, No. R80-1-11 (3 ♀); Manatee Co., Anna Maria Island, 20.ii.1993, *Aleurothrixus floccosus* (Mask.) on sea grape, Rose & Kring (7 ♀); **PERU:** Lima: ix.1974, *Aleurothrixus floccosus* on citrus, J. S. Torres (9 ♀). All specimens from MJR.

Eretmocerus staufferi Rose and
Zolnerowich, new species
(Figs. 23-25, 32)

Diagnosis.—Females of *E. staufferi* can be distinguished by the extremely elongate club that is 8.2–9.1× as long as wide (Fig. 23) and the distinct brown or brown orange mesosoma (Fig. 25). No other species has such an elongate club or the mesosoma brown orange.

Males also have the distinct brown or brown orange mesosoma (Fig. 32) that is unlike that of any other species of *Eretmocerus*.

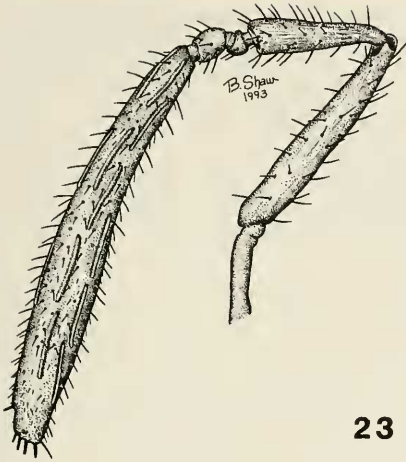
Female.—Length of critical point-dried specimens 0.53–0.63 mm. Critical point-dried material with vertex orange red; face

and gena paler and more yellow. Antenna colored as face. Mesosoma brown orange. Gaster yellow orange. Legs varying from testaceous to tan, tarsi slighter darker than tibiae. Wings slightly fuscous. Specimens mounted in Hoyer's usually with mesoscutum and scutellum pale medially (Fig. 25).

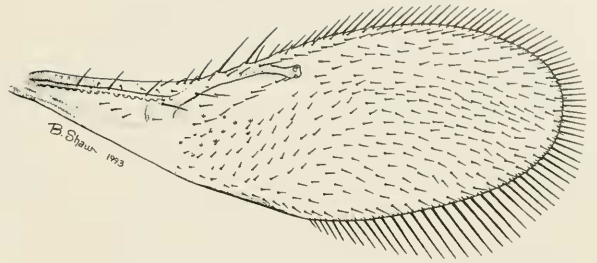
Face and occiput with transverse substrigulate sculpture, interscrobial area vertically substrigulate. Antenna (Fig. 23) with radicle 4.3× as long as wide; scape 5.7× as long as wide, 2.5× length of radicle, 1.8× length of pedicel, 0.6× length of club; pedicel 3.3× as long as wide, 1.4× length of radicle, 0.6× length of scape, 0.3× length of club. Funicle I triangular, 1.2× as long as wide; funicle II 0.9× as long as wide. Club 8.2–9.1× as long as wide, 1.8× length of scape, 3.3× length of pedicel. Antennal ratio 1:2.5:1.4:4.5.

Mesoscutum trapezoidal, usually with 6 setae but supernumerary setae common, anterior $\frac{1}{3}$ – $\frac{1}{2}$ with strong reticulate sculpture, narrow median area with substrigulate sculpture, remainder with elongate reticulate sculpture. Parapsis with 2 setae and substrigulate sculpture; axilla with 1 seta and substrigulate sculpture. Scutellum with 4 setae and 2 placoid sensilla lateral to and closer to posterior setae, with strong substrigulate sculpture, medially varying from reticulate to substrigulate, posterolateral margins varying from reticulate to substrigulate. Propodeum with substrigulate sculpture medially, laterally with strong substrigulate sculpture, remainder smooth or slightly substrigulate. Endophragma extending to posterior margin of gastral tergite I.

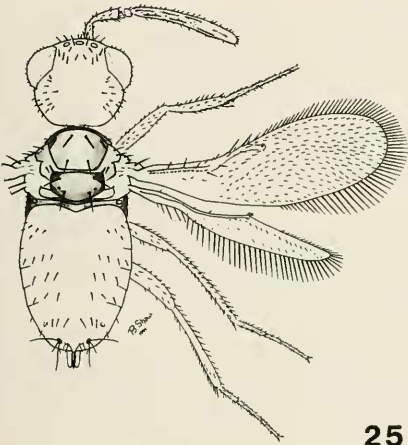
Forewing (Fig. 24) 3× as long as wide at width I, 2.7× as long as maximum width of disc. Longest anterior alary fringe 0.17× width of disc, longest posterior alary fringe 0.3× width of disc. Base of wing usually with 3–4, occasionally 2–6, setae, distal portion of costal cell usually with 2–3, occasionally 1–4, setae. Marginal vein with 3 long setae, 8–12 setae between marginal vein and linea calva. Linea calva closed posteriorly by setae, with 10–17 tubercles on ventral surface of wing near posterior



23



24



25

Figs. 23–25. *Eretmocerus staufferi*. 23, ♀ antenna. 24, ♀ forewing. 25, ♀ habitus.

end of linea calva; a group of 33–39 setae including those forming distal edge of linea calva point toward anterior margin of wing, remaining 126–223 setae in disc point to distal apex of wing. Ratio of submarginal: marginal:stigmatal veins 2.9:1.2:1.

Hind wing 7× as long as wide and with 16–38 setae in the center.

Gastral tergite I with substrigulate sculpture, lateral margins with broad imbricate sculpture and with stippling; gastral tergites I–VI with paired setae as follows: 2–6, 3–7, 3–7, 4–8, 4–10, 3–4. Syntergum with 5–10 setae.

Ovipositor slightly exerted and 0.8× length of club, 2.6× length of pedicel, 1.4× length of scape, 0.9× length of midtibia.

Male.—Specimens mounted in Hoyer's with head amber; eyes bright red. Radicle and scape slightly fuscous, scape darker in distal 1/3; pedicel dark fuscous; multiporous plate sensilla fuscous. Pronotum fuscous. Mesoscutum fuscous, darkest anteriorly (Fig. 32). Parapsis, axilla, tegula, and scutellum fuscous, scutellum darkest along margins. Metanotum fuscous, darkest medially. Propodeum fuscous, darkest along lateral margins. Gaster slightly fuscous,

with gastral tergite I darker medially. Aedeagus fuscous. Foreleg except coxa and trochanter slightly fuscous; midtrochanter, femur, and tibia slightly fuscous, tarsi darker; hind leg slightly fuscous, femur and proximal $\frac{2}{3}$ of tibia darkest. Fore- and hind wings slightly fuscous.

Host.—Reared from *Bemisia (tabaci complex)* and *Trialeurodes abutiloneus* (Haldeman), the bandedwinged whitefly.

Discussion.—There were only two male specimens in the original collections of *E. staufferi*. Males are not common in laboratory cultures and are not needed for production of females. This distinct thelytokous species is being evaluated for its biological control potential in California, Texas, and the Netherlands.

Etymology.—Named in honor of R. S. Stauffer, who found this species attacking *Bemisia (tabaci complex)* and *T. abutiloneus* at TAMU.

Holotype.—♀ mounted in balsam on a slide labelled, "USA: Texas/Hidalgo Co./Mission/Biological/Control/Laboratory/F₂ lab culture/M94002" "original/material:/USA: Texas/Brazos Co./College Station/10.xii.1993" "Rose & Stauffer/ex: Bemisia/tabaci/on: tomato". Deposited in USNM.

Paratypes.—USA: same data as holotype (6 ♀ mounted in balsam, 15 ♀ card-mounted); Texas: College Station, glasshouse, TAMU, 29.xi.1993, Host *B. tabaci* & *T. abutiloneus*, On *Lycopersicon cheesmanii*, R. S. Stauffer (11 ♀, 2 ♂ mounted in Hoyer's). Paratypes deposited with BMNH, MJR, TAMU, UCR, and USNM.

Other specimens examined.—USA: Texas: Bexar Co., San Antonio, San Antonio Botanical Garden greenhouse, 11.vii.1991, *Bemisia tabaci* on *Hibiscus lasiocarpus*, C. Moomaw (1 ♀); Brazos Co., College Station, Crop Biosciences Bldg. GH, TAMU, 18–22.xi.1993, *Bemisia tabaci* on tomato, R. S. Stauffer (20 ♀); College Station, TAMU culture, 7.x.1994, *Bemisia tabaci* on *Hibiscus*, M. Hunter (14 ♀, 7 ♂); College Station, TAMU Biotech Greenhouse,

7.x.1994, *Bemisia* on tomato, M. Hunter (1 ♂); College Station, TAMU BC Labs, 4.ii.1995, *Bemisia* on *Hibiscus*, M. Hunter (1 ♂). All specimens from MJR.

Eretmocerus tejanus Rose and
Zolnerowich, new species

(Figs. 26–28, 33)

Diagnosis.—Females of *E. tejanus* can be distinguished by the club that is 6.2–7.1× as long as wide (Fig. 26), pedicel that is 3–3.7× as long as wide and 0.29–0.36× as long as the club, mesoscutum with 6 setae, and gastral tergite II usually with 2 pairs, but occasionally 1 pair, of lateral setae (Fig. 28).

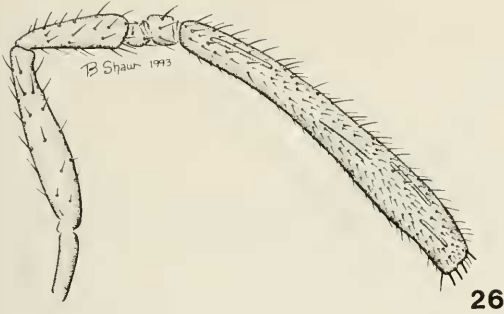
Females of *E. tejanus* are very similar to *E. corni* and *E. eremicus*. Females of *E. corni* have the pedicel 2.4–3.1× as long as wide and 0.25–0.30× as long as the club (Fig. 6), and have not been reliably recorded from *Bemisia (tabaci complex)*. *Eretmocerus eremicus* has the anterior alary fringe of the forewing slightly longer (Fig. 11), and gastral tergite II usually has 1 pair, but occasionally 2 pairs, of lateral setae (Fig. 12).

Males of *E. tejanus* can be distinguished by the longitudinal fuscous bands on the mesoscutum (Fig. 33). Males of *E. corni* lack longitudinal fuscous bands on the mesoscutum, and males of *E. eremicus* have the mesoscutum fuscous along the anterior margin (Fig. 30), or with a light fuscous "T" shape (as in Fig. 31), or evenly fuscous.

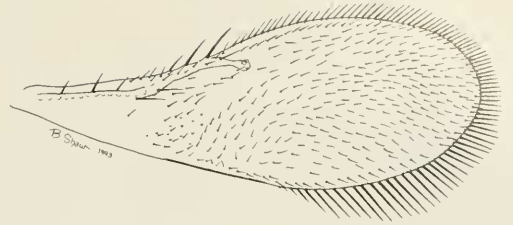
Female.—Length of critical point-dried specimens 0.44–0.59 mm. Head and body varying from white testaceous to tan yellow, with darker specimens having the vertex orange yellow. Eyes grey red, ocelli clear. Legs testaceous, tarsi occasionally slightly darker than tibiae. Wings hyaline.

Specimens mounted in Hoyer's with head amber and body pale yellow.

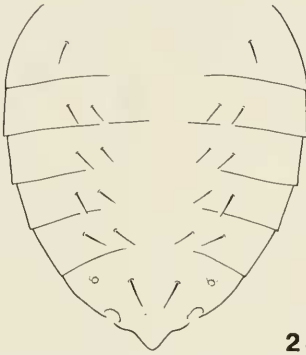
Face and occiput with transverse substri-gulate sculpture, interscrobal area vertically substri-gulate. Antenna (Fig. 26) with radi-



26



27



28

Figs. 26–28. *Eretmocerus tejanus*. 26, ♀ antenna. 27, ♀ forewing. 28, ♀ gaster.

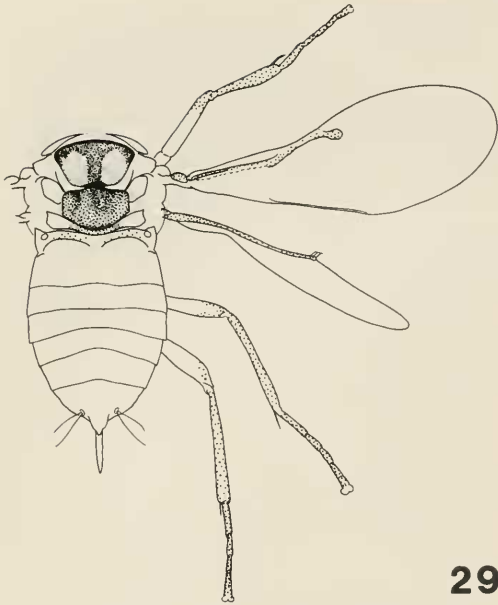
cle $4.2\times$ as long as wide; scape $5\times$ as long as wide, $2.1\times$ length of radicle, $1.6\times$ length of pedicel, $0.6\times$ length of club; pedicel $3\text{--}3.7\times$ as long as wide, $1.4\times$ length of radicle; $0.6\times$ length of scape, $0.29\text{--}0.36\times$ length of club. Funicle I triangular, $1.1\times$ as wide as long; funicle II subquadrate. Club $6.2\text{--}7.1\times$ as long as wide, $1.8\times$ length of scape, $2.8\times$ length of pedicel. Antennal ratio $1:2.2:1.4:3.5$.

Mesoscutum trapezoidal and with 6 setae, anterior $\frac{1}{4}$ with reticulate sculpture, substrigulate sculpture in narrow triangular medial area, remainder with elongate reticulate sculpture. Parapsis with 2 setae, with fine reticulate sculpture proximally and substrigulate sculpture distally; axilla with 1 seta and substrigulate sculpture. Scutellum with 4 setae and 2 placoid sensilla lateral to and closer to posterior setae, and elongate substrigulate sculpture. Propodeum with faint substrigulate sculpture medially

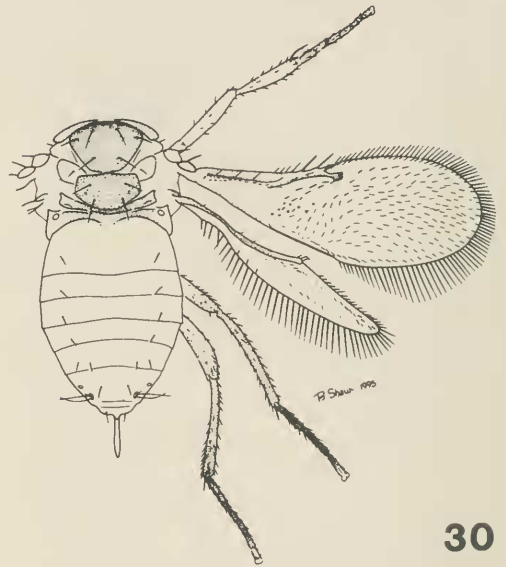
and around spiracles. Endophragma extending into gastral tergite II.

Forewing (Fig. 27) $2.9\times$ as long as wide at width I, $2.6\times$ as long as maximum width of disc. Longest anterior alary fringe $0.13\times$ width of disc, longest posterior alary fringe $0.28\times$ width of disc. Base of wing usually with 1 seta, occasionally 1–3, distal portion of costal cell usually with 2–4, occasionally 1–4, setae. Marginal vein with 3 long setae, 9–12 setae, occasionally 9–14, between marginal vein and linea calva. Linea calva closed posteriorly by setae, with 10–15 tubercles on ventral surface of wing near posterior end of linea calva; a group of 26–37 setae including those forming distal edge of linea calva point toward anterior margin of wing, remaining 162–208 setae in disc point to distal apex of wing. Ratio of submarginal:marginal:stigmal veins $3:1.3:1$.

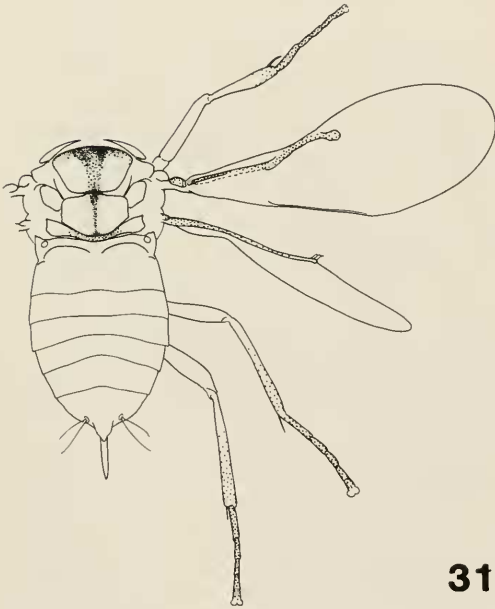
Hind wing $7.3\times$ as long as wide and with 3–8 setae in the center.



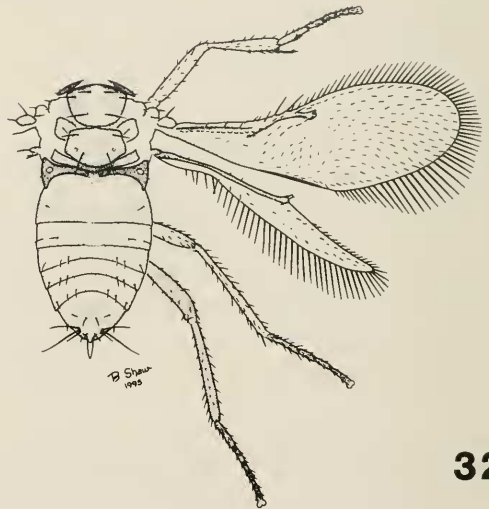
29



30



31



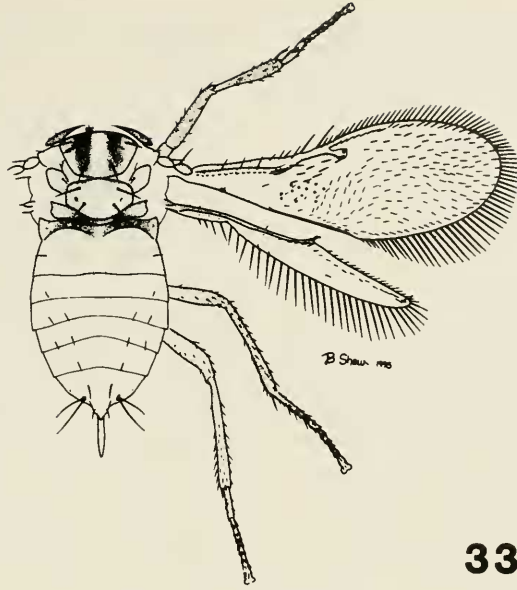
32

Figs. 29–32. ♂ habitus. 29, *Eretmocerus debachi*. 30, *E. eremicus*. 31, *E. furuhashii*. 32, *E. staufferi*.

Gastral tergite I with subtrigulate sculpture, smooth around lateral setae, lateral margins faintly imbricate with stippling; gastral tergites I–VI (Fig. 28) usually with paired setae as follows: 1, 2, 2, 2, 2, 1, al-

though specimens are known with 1–2, 0–3, 2, 2–3, 2–3, 1. Syntergum with 4 setae.

Ovipositor slightly exerted, equal in length to club, $2.8\times$ length of pedicel, $1.7\times$ length of scape, equal in length to midtibia.



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Fig. 33. *Eretmocerus tejanus*, ♂ habitus.

Male.—Length of critical point-dried specimens 0.43–0.51 mm. Critical point-dried specimens colored as female except pronotum brown dorsolaterally, mesoscutum with 2 sublateral longitudinal fuscous bands, pale medially and laterally (Fig. 33), scutellum slightly fuscous, foretarsi slightly darker than tibia.

Specimens mounted in Hoyer's with head amber. Radicle and scape fuscous, with scape darker at apex; pedicel dark fuscous; multiporous plate sensilla of club fuscous. Pronotum fuscous. Mesoscutum dark fuscous along anterior margin, slightly less fuscous along length of mesoscutum, medially and laterally pale, creating 2 longitudinal fuscous bands (Fig. 33). Parapsis and axilla slightly fuscous. Scutellum fuscous to slightly fuscous, usually darker along anterior and posterior margins. Metanotum slightly fuscous, darker medially. Propodeum fuscous except medially and along anterolateral margins. Gaster pale to slightly fuscous. Aedeagus brown. Foreleg except coxa fuscous; midleg except coxa pale, midtibia occasionally fuscous, midtarsi brown; hind trochanter pale to slightly fuscous, hind femur slightly fuscous, tibia

darker, tarsi brown. Base of forewing and costal cell slightly fuscous; submarginal vein brown fuscous, marginal and stigmal veins slightly fuscous. Venation of hind wing brown fuscous.

Host.—Rearred from *Bemisia (tabaci)* complex).

Discussion.—*Eretmocerus tejanus* has been referred to as *E. californicus* and *E. sp. nr. californicus*. Although females of *E. tejanus* are extremely similar to those of *E. eremicus*, differences in male pigment patterns, in conjunction with reciprocal mating tests and electrophoretic analysis between populations from Arizona and California, and Texas (Hunter et al. 1996), indicate that the Texas population forms a species distinct from the populations in Arizona and California.

This species was one of the most common naturally occurring parasites of *Bemisia (tabaci)* complex) in the Rio Grande Valley of south Texas prior to the 1995 Boll Weevil Eradication Program. *Eretmocerus tejanus* was not recovered from rearing samples taken during this program. Populations of this species began to appear again during the spring of 1996, approximately

nine months following cessation of insecticide treatments. Sampling for this and other species of parasites in the Rio Grande Valley continues.

Eretmocerus tejanus has been released in central and southern California for control of *Bemisia (tabaci complex)*.

Etymology.—From Spanish *Tejano*, meaning “Texan”.

Holotype.—♀ mounted in balsam on a slide labelled, “USA: Texas/Hidalgo Co./Mission/Biological/Control/Laboratory/F3 lab culture/M94003” “original/material:/USA: Texas/Hidalgo Co./Mission/18.i.1994” “J. Rodriguez/ex: Bemisia/tabaci/on: cabbage”. Deposited in USNM.

Paratypes.—**USA:** same data as holotype (3 ♀ and 2 ♂ mounted in balsam, 14 ♀ and 10 ♂ card-mounted); **Texas:** Hidalgo Co., Weslaco, TAES greenhouse, xi.1990, Host *Bemisia tabaci*, On melon, B. Breene (6 ♀, 4 ♂ mounted in Hoyer’s); Weslaco, 10.vi.1993, Host *Bemisia* sp., On *Brassica oleraceae* [sic], C. Moomaw (19 ♀, 15 ♂ mounted in Hoyer’s). Paratypes deposited with BMNH, MJR, TAMU, UCR, and USNM.

Other specimens examined.—**Texas:** Brazos Co., College Station, TAMU, B.C. garden, 23.v.1991, *Bemisia tabaci*, C. Moomaw (1 ♀, 1 ♂); TAMU, B.C. garden, 3.vii.1991, *Bemisia tabaci* on kale, C. Moomaw (1 ♂); TAMU Green House, 6.vi.1991, *Bemisia tabaci* on squash, C. Moomaw (7 ♀, 8 ♂); Hidalgo Co., Hargill, 25.vi.1993, *Bemisia tabaci* on cabbage, Moomaw (12 ♀, 13 ♂); Hargill, 25.vi.1993, *Bemisia tabaci* on kenaf, Moomaw (14 ♀, 6 ♂); nr. Hargill, Rio Farms, 2.viii.1993, *Bemisia tabaci* on kenaf, Moomaw (8 ♀, 5 ♂); nr. Mission, Holbrook, 2.vi.1993, *Bemisia tabaci* on watermelon, Moomaw (3 ♀, 5 ♂); nr. Mission, Holbrook, 29.vi.1993, *Bemisia tabaci* on kale, Moomaw (2 ♀); nr. Mission, Holbrook farms, 26.vii.1993, *Bemisia tabaci* on pigweed, C. Moomaw (10 ♀, 8 ♂); Weslaco, 9.vii.1991, *Bemisia tabaci* on cotton, M. Rose (4 ♀, 1 ♂); Weslaco, 25.iii.1992, *B. tabaci* on cantaloupe,

Moowaw (1 ♂); Weslaco, USDA-ARS, 26.iii.1992, *B. tabaci* on sunflower, Moowaw (1 ♀, 1 ♂); Weslaco, USDA-ARS, 26.iii.1992, *B. tabaci* on sunflower, Woolley (1 ♀, 1 ♂); Weslaco, USDA-ARS, 18.vii.1992, *Bemisia tabaci* on kale, Moomaw (5 ♀, 6 ♂); Weslaco, USDA-ARS test plot refuge, 18.vii.1992, *Bemisia tabaci* on kale, M. Rose & C. Moomaw (6 ♀, 3 ♂); Weslaco, USDA-ARS, 30.x.1992, *Bemisia tabaci* on kale, Moomaw (13 ♀, 9 ♂); Weslaco, Rio Grande Valley, 1.iv.1993, *Bemisia tabaci* on cabbage, M. Rose (2 ♀, 1 ♂); Weslaco, Rio Grande Valley, 1.iv.1993, *Bemisia tabaci* on collards, M. Rose (4 ♀, 7 ♂); Weslaco, TAES, 20.iv.1993, *Bemisia tabaci* on canola, Moomaw (3 ♀, 1 ♂); Weslaco, TAES-Riley, 28.vi.1993, *Bemisia tabaci* on sunflower, C. Moomaw (5 ♀, 5 ♂); Weslaco, TAES-Riley, 27.vii.1993, *Bemisia tabaci* on sunflower, Moomaw (12 ♀, 4 ♂); Weslaco, TAES-Riley, 31.vii.1993, *Bemisia tabaci* on kale, Moomaw (9 ♀, 9 ♂); Weslaco, TAES, 21.viii.1993, *Bemisia tabaci* on cotton, Moomaw (3 ♀, 5 ♂); Weslaco, Rio Grande Valley, 19.v.1994, *Bemisia tabaci* on mixed host plants, M. Rose (25 ♀, 20 ♂). All specimens from MJR.

ACKNOWLEDGMENTS

This research was supported by funds from USDA/APHIS, USDA/ARS, USDA/National Research Initiative, the Southern Regional Sustainable Agriculture and Education Program, and the Texas Higher Education Coordinating Board. The work of G. Zolnerowich was supported by a USDA/APHIS/National Biological Control Institute Postdoctoral Fellowship in Systematics.

We express our appreciation to M. E. Schauff (Systematic Entomology Laboratory, USDA) and J. M. Heraty (UCR) for their review of the manuscript and loan of types. We thank F. D. Bennett and G. Evans (University of Florida), C. Pickett and J. Ball (CDFA), K. Hoelmer, J. Goolsby, and L. Wendel (USDA/APHIS), R. Carruthers and G. Butler (USDA/ARS), and D. Headrick (UCR) for their kind collaboration and

for providing specimens. We thank Ben Shaw for the drawings.

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